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Indian Standard

METHODS FOR GRADING AND
CLASSIFICATION OF MUSCOVITE MICA
BLOCKS, THINS AND FILMS

(First Revision)

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Indian Standard

METHODS FOR GRADING AND CLASSIFICATION OF MUSCOVITE MICA BLOCKS, THINS AND FILMS

(*First Revision*)

Mica Sectional Committee, ETDC 9

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SHRI JYOTI KUMAR SAHA (*Alternate*)

Representing

Geological Survey of India, Calcutta

Chatturam Horilram Pvt Ltd, Jhumri-Telaiya

Bihar Mica Exporters Association, Giridih

Government of Bihar, Patna
Indian Bureau of Mines, Nagpur

Export Inspection Council of India, Calcutta

Mica Trading Corporation of India Ltd, Patna
Central Electronics Ltd, Sahibabad

Madras Mica Association, Gudur

Seth Puslal Mansinghka Pvt Ltd, Bhilwara
Bharat Heavy Electricals Ltd, Hyderabad

Nathany Co, Bhilwara
C. M. Rajgarhia, Giridih

Universal Enterprises, Gudur (Nellore)
Central Glass and Ceramic Research Institute
(CSIR), Calcutta

Peak Electronics Pvt Ltd, Calcutta

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Indian Standard

METHODS FOR GRADING AND CLASSIFICATION OF MUSCOVITE MICA BLOCKS, THINS AND FILMS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 22 June 1981, after the draft finalized by the Mica Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 In 1949, ISI published two tentative Indian Standards, namely, IS : 13-1949* and IS : 14-1949† and in its capacity as the Secretariat submitted them as draft proposals to ISO/TC 56 Mica. After several years of discussion, the International Committee succeeded in preparing after its third meeting held in Paris in October 1954, a draft ISO Recommendation for Methods for Grading Muscovite Mica Blocks, Thins and Condenser Films which was finally accepted at the fourth meeting held in Harrogate (UK) in June 1958 with deletion of all references to 'condenser' for films.

0.3 Taking into consideration the views of the producers, consumers and technologists, the Sectional Committee responsible for the preparation of this standard felt that it should be related to the trade practices followed in this country in this field. Furthermore, due weightage had to be given to the need for international co-ordination among standards prevailing in different countries of the world. These considerations led the Sectional Committee to base this standard on ISO 67 Muscovite Mica Blocks, Thins and Films — Methods for Grading by Size. The classification of muscovite mica adopted in this standard also represents to a substantial extent agreements reached at the international level by ISO/TC 56 Mica.

0.4 The development of a co-ordinated system of classification of muscovite mica according to visual quality has been found to present a number of difficulties. The quality classification of muscovite mica, being based on visual tests, depends on individual opinion. Also, products of different mines vary in physical characteristics to such an extent that the development

*Methods for grading processed mica (*since withdrawn*).

†Classification of processed muscovite mica (*since withdrawn*).

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of a single standard, with reasonable limits of tolerances, becomes an acutely difficult task. Added to these difficulties are the facts that quality classification has to be carried out by a large number of individual workers, and that it is highly influenced by such circumstantial factors as lighting conditions, mood of the inspector, etc. Under these circumstances, any standard for quality classification of mica, such as the one described in this standard, can give at best an approximate idea of a particular quality and its relative position with respect to other qualities. Moreover visual classification may or may not have any bearings on the end use.

0.5 Mention should be made in this context of IS : 9455-1980*, which provides a basis for classification of muscovite mica blocks, thins and films based on electrical properties. It specifies three different grades based on power factor range. Though at present no correlation exists between the visual grades of this standard and the electrical properties of IS : 9455-1980*, the advantages of electrical classification are obvious, each grade relating to specific applications. In view of the inherent advantages of the latter (the tests being scientific and directly related to end use) over the former, adoption of electrical classification by the mica trade is recommended wherever possible.

0.6 The Government of India had introduced throughout the country uniform weights and measures based on the metric system. Keeping this decision in view, a new set of grade designations based on metric units was included in this standard together with the existing grade designations. The new designations are based on preferred numbers, which are dealt with in ISO : 3-1973 and IS : 1076-1967†. This has been done with a view to simplify the notation and rationalizing the grading system to promote easy understanding in future. It is proposed that, in order to differentiate between the old and the new grade designations, the word 'size' be used in connection with the new grades while retaining the word 'grade or number' to designate the old grades. For example, 'size 630' in the new system is equivalent to 'grade OOOE special' in the old, and size 40 is equivalent to 'No. 4'.

0.7 Requirements in respect of the minimum thickness of block mica appear to be different in different consuming countries. However, in view of general acceptance amongst the importers as well as exporters, the minimum thickness of block mica is taken as 0.175 mm. Producer countries are known to be prepared to supply block mica meeting this limit.

0.8 The presence of 'V' cuts in full-trimmed mica has been a point of much discussion in ISO/TC 56. While all other Member Bodies agreed that specifying the minimum yield of a piece of mica (see 3.2) would automati-

*Classification of muscovite mica blocks, thins and films based on electrical properties.

†Preferred numbers (*first revision*).

cally limit the presence of 'V' cuts, the French Member Body expressed the opinion that it would be desirable not to allow any 'V' cuts.

0.9 With a view to making allowances for unavoidable variations during manufacture and to facilitate commercial transactions, certain tolerances on all sizes of blocks, thins and films have been included in this standard. Tolerances to be permitted in acceptance inspection would always be a matter for agreement between the buyer and the seller and tolerances so agreed, unless otherwise stated, shall be considered as substitute for and not additional to any tolerances stated in this standard.

0.10 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard describes a standard system of grading and classifying muscovite mica blocks, thins and films according to size, visual qualities, and presence of structural imperfections.

2. TERMINOLOGY

2.0 For the purpose of this standard, definitions given in IS : 1885 (Part LIII)-1980† shall apply.

3. GRADING

3.1 General — The standard grading system for all full-trimmed muscovite mica is based on the maximum usable rectangle (usable area) that may be cut from the specimen, and not on the total area for half-trimmed muscovite mica (see 3.2.2). The grade designations for muscovite mica blocks, thins and films and the corresponding areas of the usable rectangles with minimum dimension of one side shall be as given in Table 1 and indicated in Fig. 1. All mica blocks, thins and films shall contain a fair proportion of sizes throughout the entire range of the specified grade.

3.1.1 All specimens to be graded shall first be trimmed (see 3.2). The trimmed specimens shall then be graded according to the procedure laid down in 3.4. All muscovite mica blocks, thins and films shall meet, in the usable rectangle, the requirements of the desired visual quality specified in 4.

*Rules for rounding off numerical values (revised).

†Electrotechnical vocabulary : Part LIII Mica.

**TABLE 1 STANDARD GRADING TABLE FOR MUSCOVITE MICA
BLOCKS, THINS AND FILMS**
(*Clauses 3.1, 3.3 and Fig. 1*)

GRADE DESIGNATION		AREA OF USABLE RECTANGLE, cm ²		MINIMUM DIMENSION OF ONE SIDE OF USABLE RECTANGLE	PERMISSIBLE STRIP TOLERANCE
Old (Grade or Number) (1)	*New (Size) (2)	From (Incl) (3)	To (Excl) (4)		
				cm (5)	(6)
OOEE Special	630	645 and above		10.2	Nil
OEE Special	500	516	645	10.2	Nil
EE Special	400	387	516	10.2	Nil
E Special	315	310	387	10.2	Nil
Special	250	232	310	8.9	Nil
1	160	155	232	7.6	5 percent of pieces having width down to and including 5.1 cm
2	100	97	155	5.1	5 percent of pieces having width down to and including 3.8 cm
3	63	64	97	5.1	5 percent of pieces having width down to and including 3.8 cm
4	40	39	64	3.8	5 percent of pieces having width down to and including 2.5 cm
5	20	19.4	39	2.5	Nil
5½	16	14.5	19.4	2.2	Nil
6	06	6.4	14.5	1.9	Nil
7	05	4.8	6.4	1.6	Nil

*This system of grade designations should be considered as a first step towards a unified classification of all forms of mica based on a series of preferred numbers recommended in IS : 1076-1967 'Specification for preferred numbers (*first revision*)'.

3.2 Trimming — All full-trimmed muscovite mica blocks, thins and films shall be trimmed as to remove all cracks, holes, reeves, cross-grains, etc, so as to comply with the specification for the desired visual quality. Trimming should follow the natural contour of mica. As far as possible, all marginal cracks should be removed by re-cutting. However, marginal crack in length

not exceeding 1/10th of the usable length of the sheet may be allowed in qualities 'Ruby stained first' and inferior.

3.2.1 The total area of full-trimmed sizes shall be not more than 2 times the area of the largest usable rectangle or, in other words, shall have a rectangular yield of at least 50 percent with the tolerance that not more than 10 percent of blocks by weight shall have a yield of less than 50 percent. The usable area of full-trimmed mica is the area of the maximum rectangle obtainable.

3.2.2 Half-trimmed mica shall be trimmed on two sides, with at least two-thirds of the pieces trimmed on two adjacent sides, the balance of the pieces trimmed on the two parallel long sides with no cracks extending into the area by which the piece is graded. The foregoing does not apply to sizes 06 and 16 (grades 6 and $5\frac{1}{2}$), for which at least one of any two trimmed sides shall be free of cracks and no crack may extend into the area by which the piece is graded. The mica shall be capable of permitting the cutting of rectangles of accepted size and quality with a weight loss not to exceed 60 percent based on the total inspection sample.

3.2.3 If limitation as to the size, number and frequency of 'V' cuts is described, it shall be subject to agreement between the buyer and the seller.

3.2.4 Muscovite mica blocks shall be finished with sickle or knife-cut bevelled edges.

3.3 Grading Chart— The range of area and the minimum dimensions of one side of the usable rectangle for the various grades given in Table 1 shall apply for grading all muscovite mica blocks, thins and films. A grading chart based on this table is shown in Fig. 1. This chart or templates prepared in accordance with it, shall be used for grading in accordance with the method outlined in 3.4. Size shall be determined on the grading chart covering outer lines of the right angle and simply touching the lines opposite to the same.

3.4 Method of Grading — The specimen to be graded shall be laid upon the chart or corresponding template so that it covers point 0 and has its maximum and minimum dimensions extending along and covering lines OA and OB respectively. The specimen shall be shifted until the usable area completely covers the latest rectangle, determined by a diagonal extending from point 0 to a point lying in one of the regions designated 05, 06, 16, 20, 40... 500, 630. The number of the region in which the diagonal of the rectangle terminates, designates the grade of the specimen.

3.4.1 For blocks, all dimensions shall apply to the smaller surface measured from the foot of the bevel-trimmed edge.

3.4.2 In no case shall a crack extend into the largest usable rectangle as stated in 3.2.1.

4. CLASSIFICATION BY VISUAL QUALITY

4.1 Classification of muscovite mica blocks, thins and films by visual quality shall follow trimming and grading in accordance with 3 and shall be as given in 4.2 and 4.3.

4.2 Blocks and Thins

4.2.1 The classification of visual quality of muscovite mica blocks and thins shall fall into the following categories :

- V-1 Ruby Clear and Slightly Stained,
- V-2 Ruby Good Stained,
- V-3 Ruby AQ,
- V-4 Ruby Stained First,
- V-5 Ruby BQ,
- V-6 Ruby Heavy Stained,
- V-7 Ruby Densely Stained,
- V-8 Spotted,
- V-9 Red/Copper Stained,
- V-10 Green/Brown First, and
- V-11 Green/Brown Stained or BQ.

4.2.2 The classification of muscovite mica blocks and thins into 11 categories as above, shall be judged in terms of the requirements specified in Table 2 and the verbal descriptions as given below:

- a) V-1 *Ruby Clear and Slightly Stained* — Hard, of uniform colour, free from all vegetable and mineral stains, cracks, buckles and other similar defects and foreign inclusions, except that may be very slightly wavy, and may contain slight air-inclusions in not more than 1/3rd of the usable area. Crystallographic discolouration is permitted to a limited extent.
- b) V-2 *Ruby Good Stained* — Hard, free from cracks, mineral stains and other similar defects and foreign inclusions, except that may be medium wavy with slight buckles but not rippled and may contain vegetable stains and slight mineral stains not exceeding 2 speck within the usable area. The entire area may have air-inclusions if not heavily concentrated in not more than 3/4th of the usable area. Crystallographic discolouration is permitted to a limit of not more than 5 percent of the bulk.
- c) V-3 *Ruby AQ* — Hard, free from cracks and other similar defects and foreign inclusions, except that may be wavy with slight buckles

and may contain medium vegetable stains which are usually brown diffused stains, and the entire area may have air-inclusions if not heavily concentrated. Occasional mineral stains and a few small black dots are allowed. Crystallographic discolouration is permitted.

- d) V-4 *Ruby Stained First* — Hard, free from cracks and other similar defects and foreign inclusions except that may contain medium vegetable stains wavy with slight buckle and slight clay and mineral stains. Air-inclusion in the entire area is permitted even if heavily concentrated. A few black dots are allowed. Crystallographic discolouration is permitted.
- e) V-5 *Ruby BQ* — Hard, free from cracks and other similar defects and foreign inclusions, except that may be wavy and slightly buckled and may contain heavy air-inclusions, heavy vegetable stains and medium mineral stains and black dots and may contain diffused brown stains and clay. Crystallographic discolouration is permitted.
- f) V-6 *Ruby Heavy Stained* — May be softer than better qualities but free from foreign inclusions and other similar defects, may contain marginal cracks, may be wavy and buckled, may contain heavy air-inclusions, heavy vegetable stains, medium mineral stains and black dots. Distinctly inferior as regards to rigidity and hardness. Crystallographic discolouration is permitted.
- g) V-7 *Ruby Densely Stained* — Soft, containing heavy stains and foreign inclusions, wavy, cracks, buckles, black dots, cross grains and similar other defects. Crystallographic discolouration is permitted.
- h) V-8 *Spotted* — Hard, free from cracks and other similar defects and foreign inclusions, except that may be medium wavy and may contain slight buckles and vegetable stains, black and tiny red spotted mineral stain and heavy air-inclusions. Crystallographic discolouration is permitted.
- j) V-9 *Red/Copper Stained* — May be soft but free from cracks and other similar defects and foreign inclusions, except that may be medium wavy and may contain slight buckles and vegetable stains, may have mud stains, black or red spotted mineral stains with black, red/copper coloured lines and/or bars and heavy air-inclusions. Crystallographic discolouration is permitted.
- k) V-10 *Green/Brown First* — Hard, free from cracks and other similar defects and foreign inclusions but may be wavy with slight buckles and may contain medium vegetable stains and the entire area may have medium air-inclusions if not heavily concentrated. Crystallographic discolouration is permitted.

- m) *V-11 Green/Brown Stained or BQ* — Free from cracks and other similar defects and foreign inclusions but may be wavy and may contain heavy air-inclusions, heavy vegetable stains and medium mineral stains (black dots). Crystallographic discolouration is permitted.

4.3 Films — Visual quality classification of muscovite mica films shall fall within the following categories:

- a) *First Quality* — Hard, of uniform colour, free from vegetable and mineral stains and foreign inclusions. Free from cracks, buckles and other similar defects. May be slightly wavy and may contain slight air-inclusions in not more than 1/3rd of the usable area. Crystallographic discolouration is permitted to a limited extent.
- b) *Second Quality* — Hard, free from cracks, mineral stains and other similar defects and foreign inclusions. May be medium wavy with slight buckles and may contain slight vegetable dots. May have air-inclusions, but not heavily concentrated in not more than 3/4th of the usable area. Crystallographic discolouration is permitted to a limited extent.
- c) *Third Quality* — Free from cracks and other similar defects and foreign inclusions except that may be wavy with slight buckles and may contain medium vegetable stains which are usually brown diffused stains and the entire area may have air-inclusions if not heavily concentrated. Crystallographic discolouration is permitted.

5. TOLERANCES

5.1 Grading — In any one batch or shipment, a tolerance of 5 percent by weight of the next lower grade shall be permissible.

5.2 Classification — In all categories of visual quality of muscovite mica blocks and thins, and for first quality films, a tolerance of 10 percent by weight of pieces having characteristics of the next lower category shall be permissible. In the case of second and third quality films, a tolerance of 5 percent of off-standard pieces by weight shall be permissible.

6. PACKING

6.1 Mica shall be packed in wooden cases and secured in such a way as to prevent movement during transit. The inside of cases shall be free from nail-projections and shall be lined with paper.

TABLE 2 QUALITY CLASSIFICATION OF MUSCOVITE MICA BLOCKS AND THINS BASED ON VISUAL PROPERTIES
(Clause 4.2.2)

VISUAL QUALITY CLASSIFICATION	UNIFORM BASIC COLOUR	AIR INCLUSION			CRYSTALLOGRAPHIC DISCOLOURATION	SMOKY STAINS	LIGHT DOTS (MINERALS)	SOOTY STAINS (MINERALS)	BLACK STAINS (MINERALS)	RED STAINS (MINERALS)	GREEN BROWN VEGETABLE STAINS	CLAY STAINS	WAVINESS			HARDNESS		STONES	BUCKLES	REEVES	RIDGES	TEARS	CRACKS OUTSIDE USABLE AREA	HAIR LINES	WEDGES	TANGLE SHEET	HERRING BONES	RIBBONED OR RULED
		Slight	Medium	Heavy									Slight	Medium	Heavy	Hard	Soft											
V-1 Ruby Clear & Slightly Stained	p	v	x	x	l	x	x	x	x	x	x	x	v	x	x	p	x	x	x	x	x	x	x	x	x	x	x	x
V-2 Ruby Good Stained	—	p	x	x	l	x	p	x	x	x	s	x	—	p	x	p	x	x	x	x	x	x	x	x	x	x	x	x
V-3 Ruby AQ	—	—	p	x	p	x	p	x	x	x	s	x	—	p	x	p	x	x	x	x	x	x	x	x	x	x	x	x
V-4 Ruby First Stained	—	—	—	p	p	x	p	x	s	x	p	s	—	p	x	p	x	x	s	x	x	x	x	x	x	x	x	x
V-5 Ruby BQ	—	—	—	p	p	x	p	p	p	x	p	p	—	p	x	p	p	x	s	x	x	x	x	x	x	x	x	x
V-6 Ruby Heavy Stained	—	—	—	p	p	x	p	p	p	x	h	p	—	—	p	p	x	x	p	x	x	x	p	x	x	x	x	x
V-7 Ruby Densely Stained	—	—	—	p	p	p	p	p	p	x	h	p	—	p	p	—	p	x	x	x	x	x	p	x	x	x	p	x
V-8 Spotted	—	—	—	p	p	—	—	—	h	s	p	p	—	p	x	p	x	x	s	x	x	x	p	x	x	x	x	x
V-9 Red/Copper Stained	—	—	—	p	p	—	—	—	—	h	—	p	—	p	p	x	—	p	x	x	s	x	p	x	x	x	p	x
V-10 Green/Brown First	—	—	p	x	p	x	x	x	x	x	v	x	p	x	x	p	x	x	s	x	x	x	x	x	x	x	x	x
V-11 Green/Brown Stained or BQ	—	—	—	p	p	—	p	p	p	x	h	p	—	—	p	x	x	x	x	x	x	x	x	x	x	x	p	x

Symbols : Blank Indication — Not Applicable
 x — Not Permissible v—Very Slight
 p — Permissible s—Slight
 l — Limited Extent h—Heavy

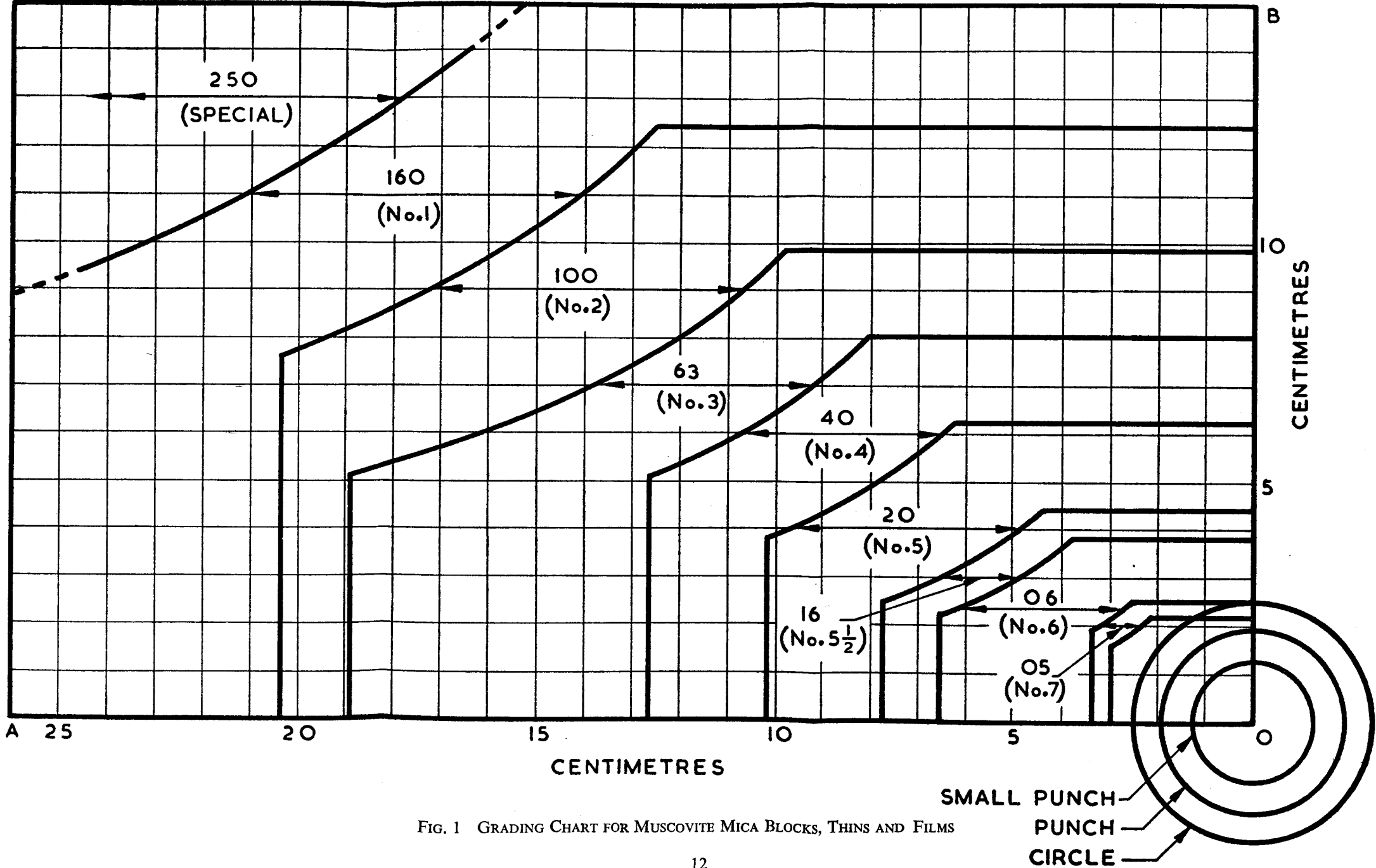


FIG. 1 GRADING CHART FOR MUSCOVITE MICA BLOCKS, THINS AND FILMS